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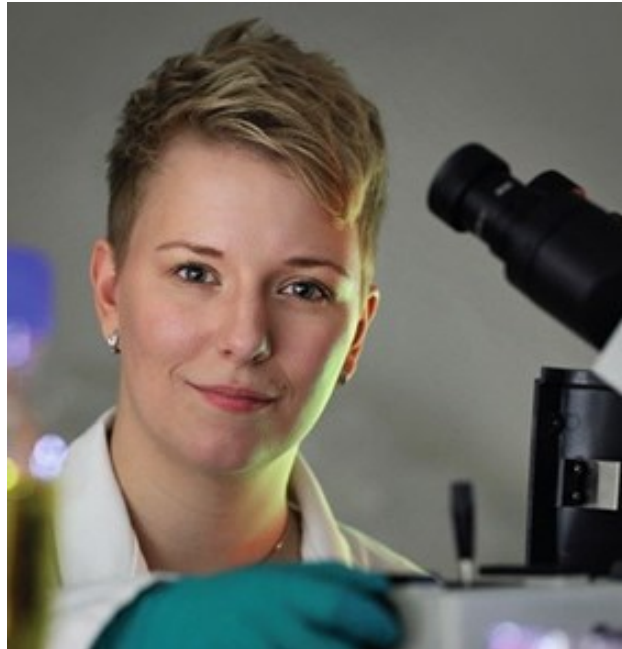
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# Surface enhanced Raman spectroscopy (SERS) sensing in aqueous sample enabled by UV/ ozone treatment



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We present the development of a detection strategy based on surface-enhanced Raman spectroscopy (SERS) sensing in water. The SERS substrates, fabricated from free-standing, gold-capped silicon nanopillars are commonly used for the detection of analytes dissolved in organic solvents and dried on the sensor surface. We developed a method where detection can be performed directly in aqueous samples using a model drug acetoaminophene (Paracetamol).

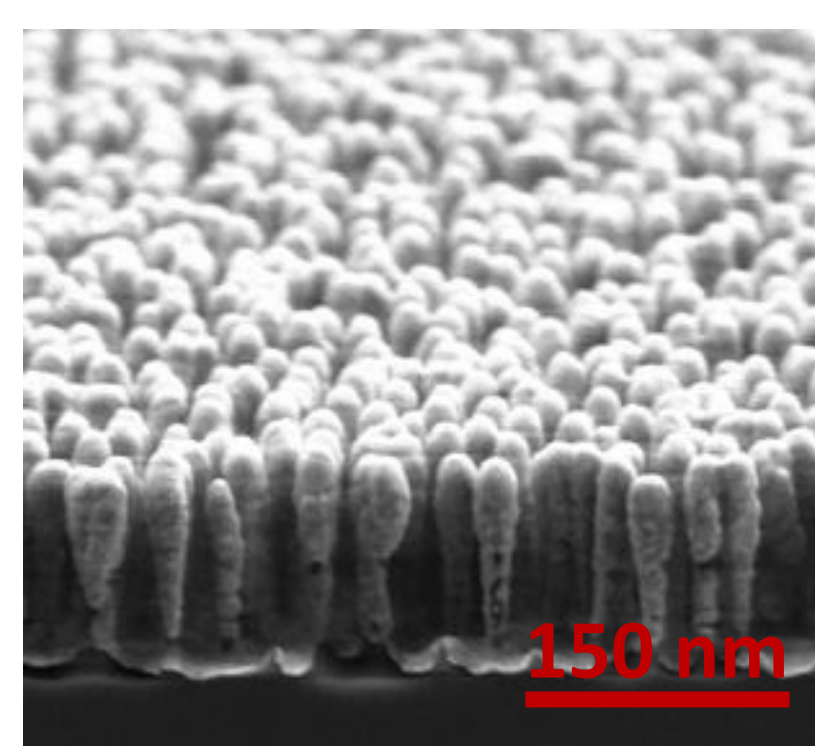
## SERS sensing in Water



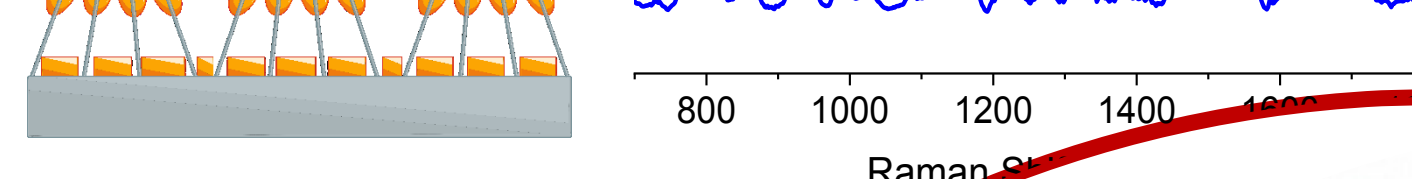
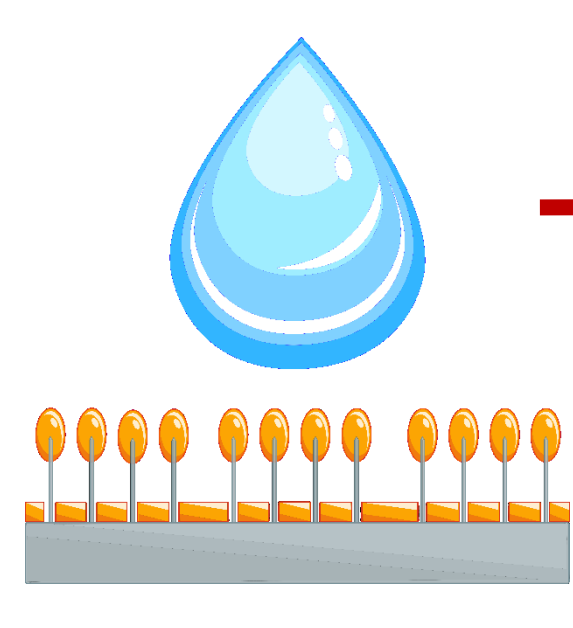
Pharmaceuticals have become integral parts of our daily life. However, this widespread availability poses a potential risk of leakage into our environment leading to possible disturbances in various eco systems. Even though low concentrations of single drugs are not necessarily harmful, cross-reactions with other drugs and accumulation can be dangerous if not carefully monitored.

### SERS Substrate - Gold Capped Nanopillars

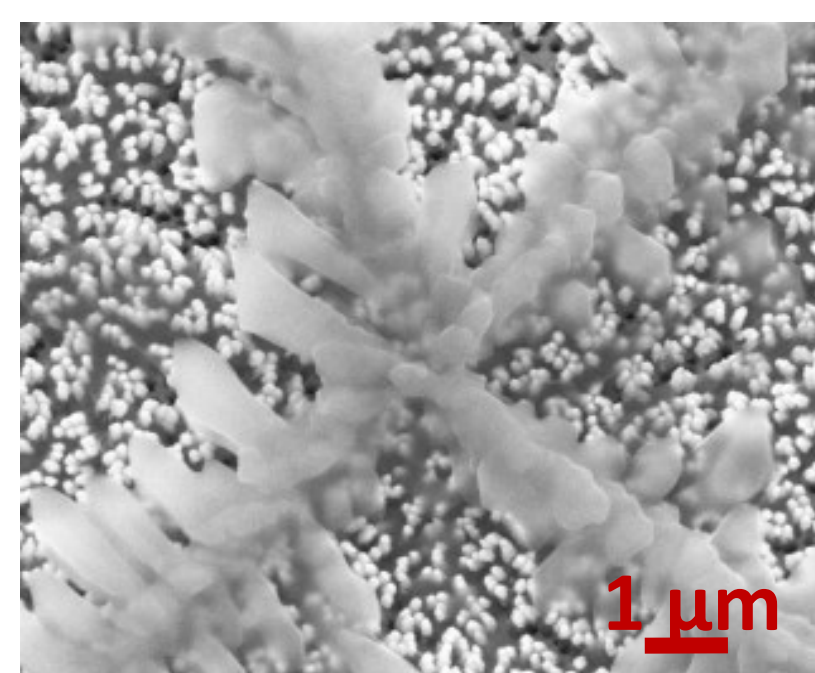
SERS is a powerful analysis technique capable of detecting molecular fingerprints of analytes with high sensitivity and fast response time. [2]



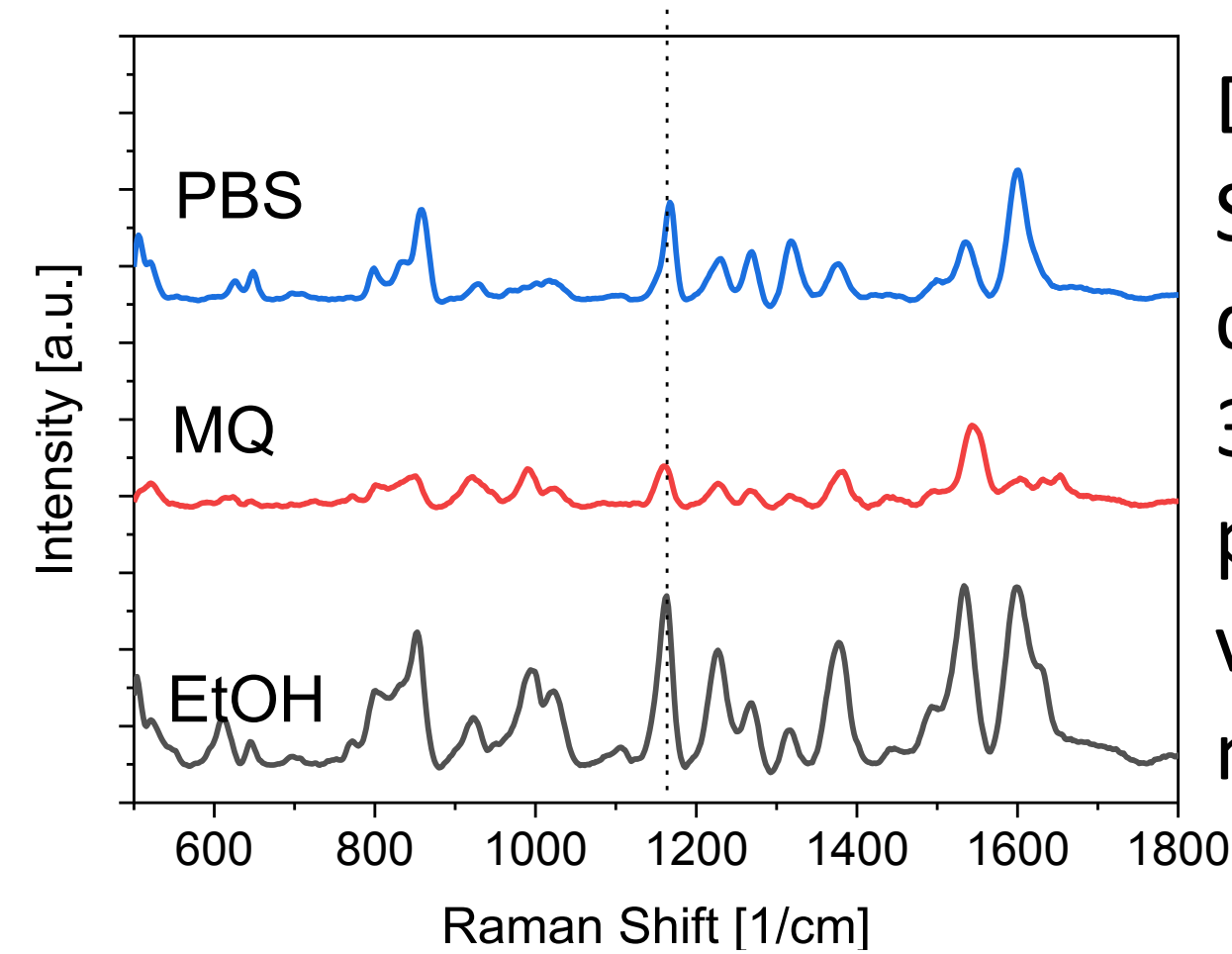
Silmeo ApS



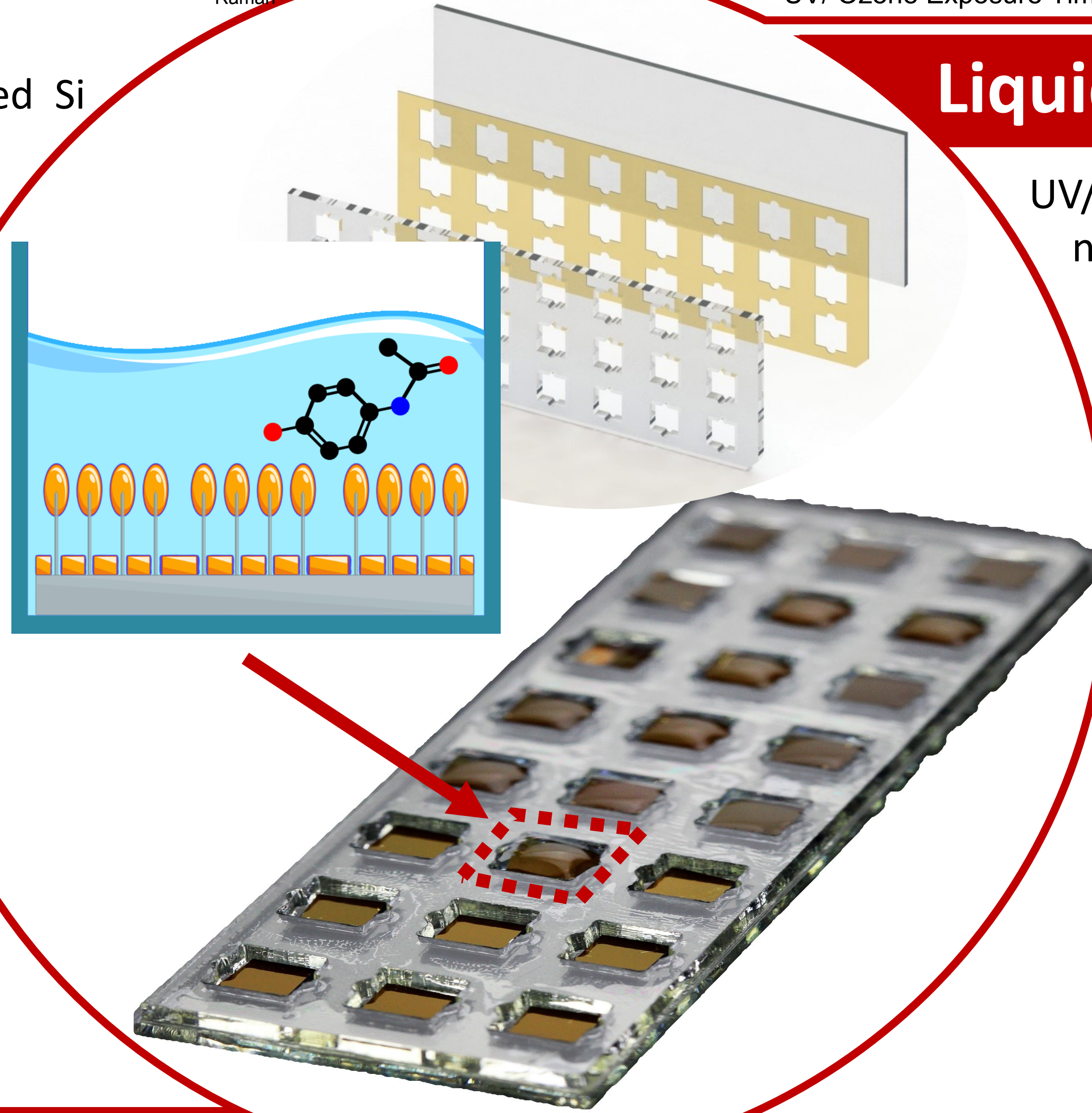
Classical dry droplet SERS sensing using gold-capped Si nanopillars. [3] Dry droplet measurements are highly Influenced by the chosen sample matrix.



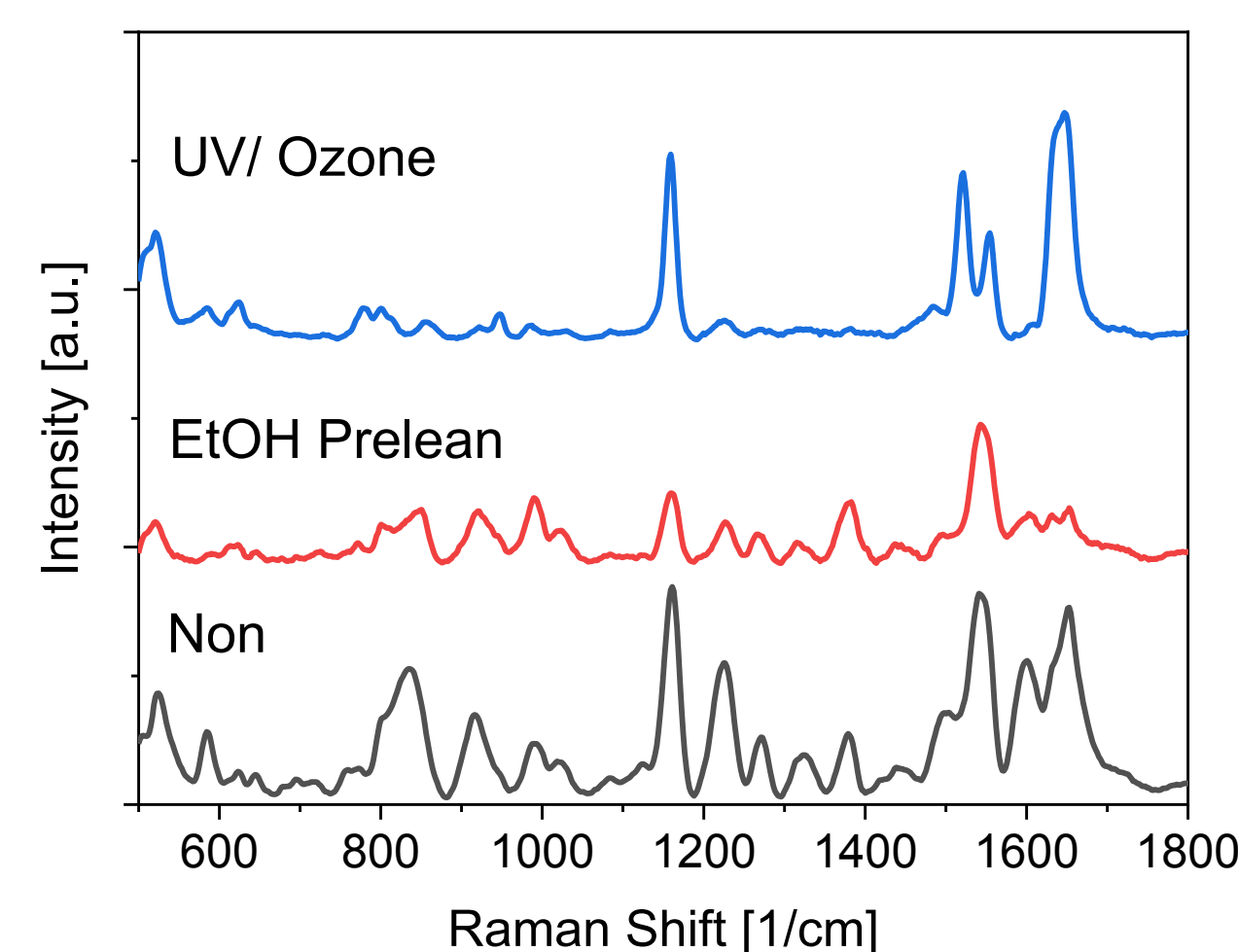
Complex matrices can lead to sensor fouling. Organic solvents are preferred, due to the **hydrophobic nature of the nanopillar** surface.



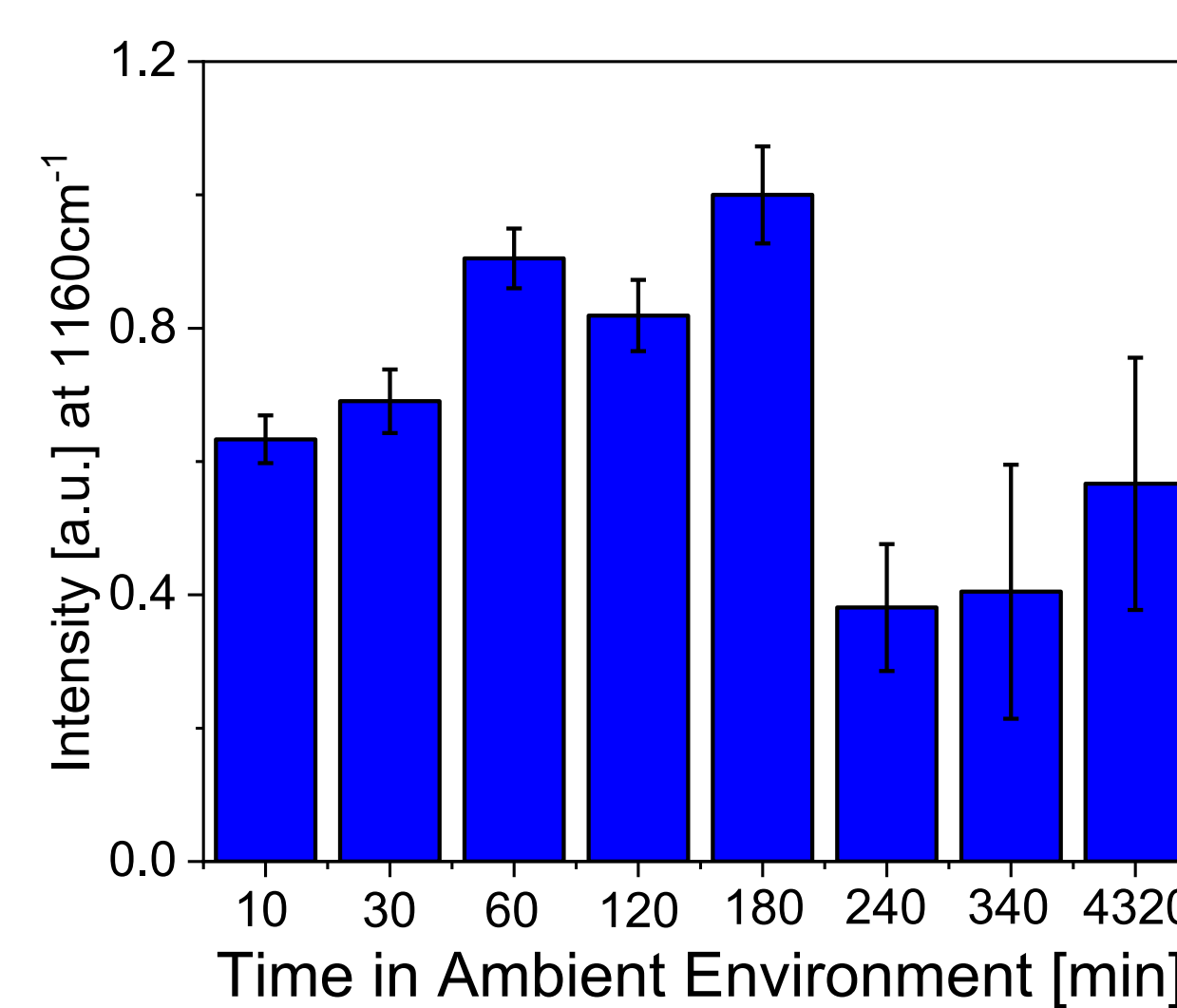
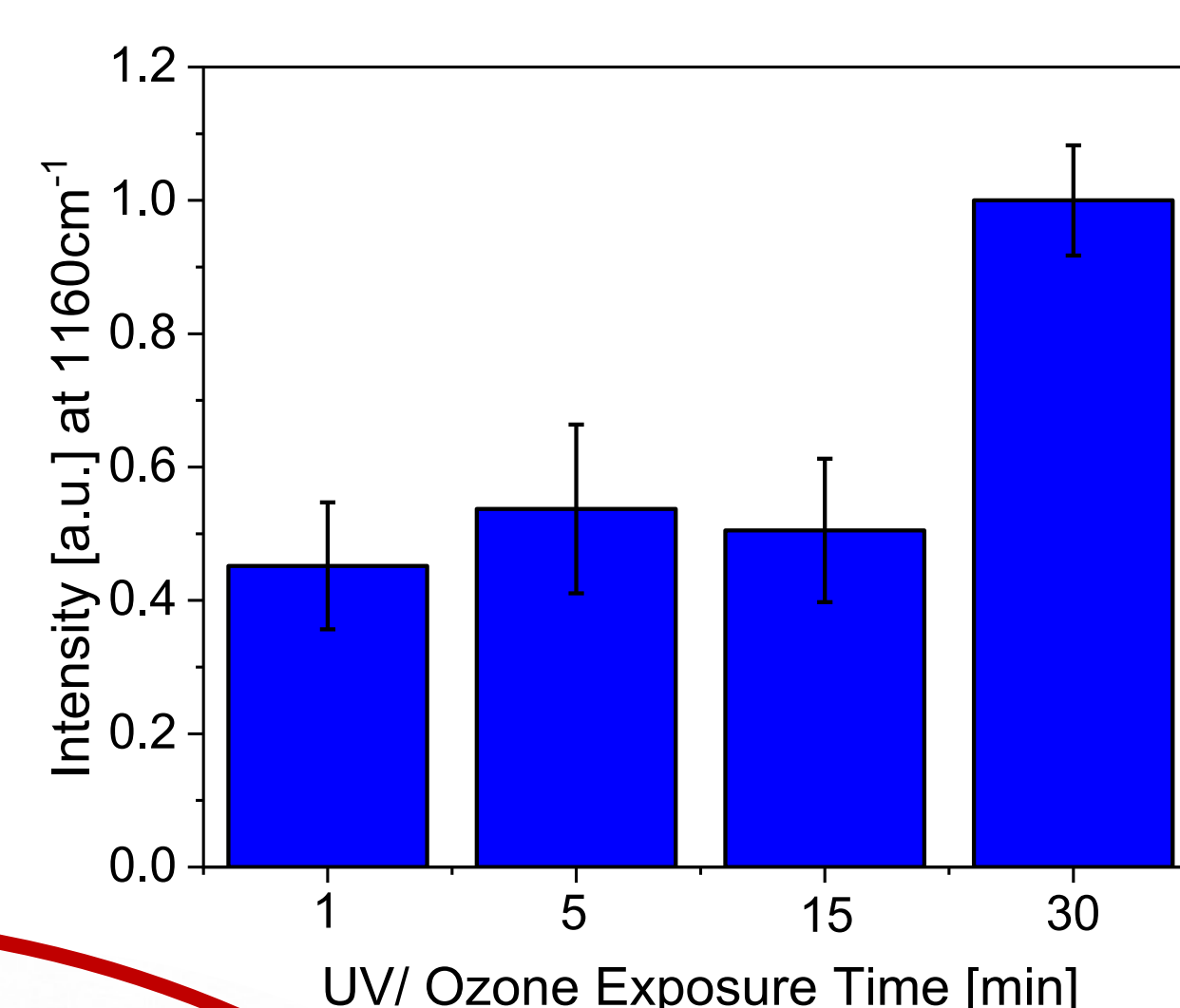
Dry droplet SERS-based detection of 350  $\mu\text{M}$  paracetamol in various aqueous matrices.



## UV/ Ozone Treatment

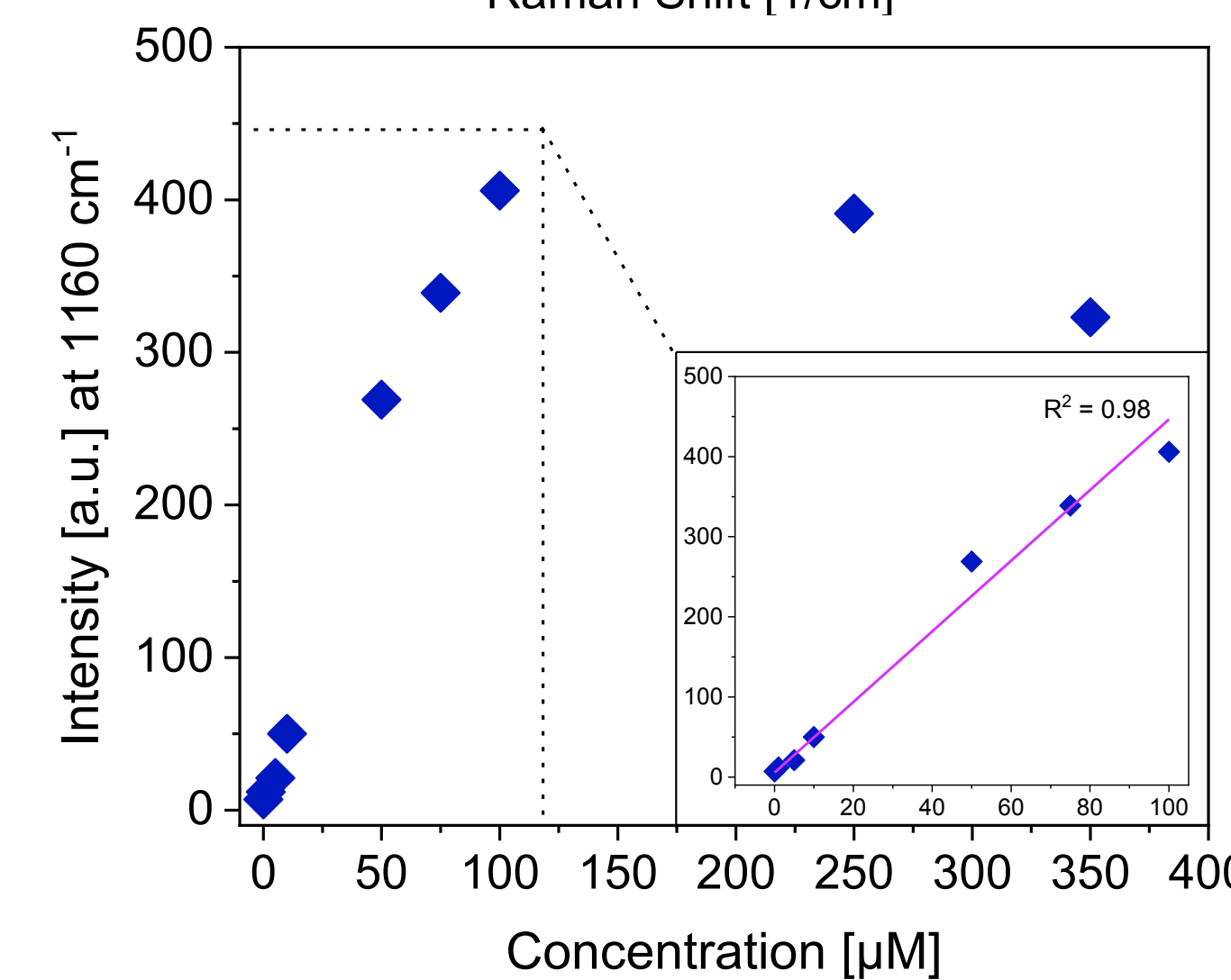
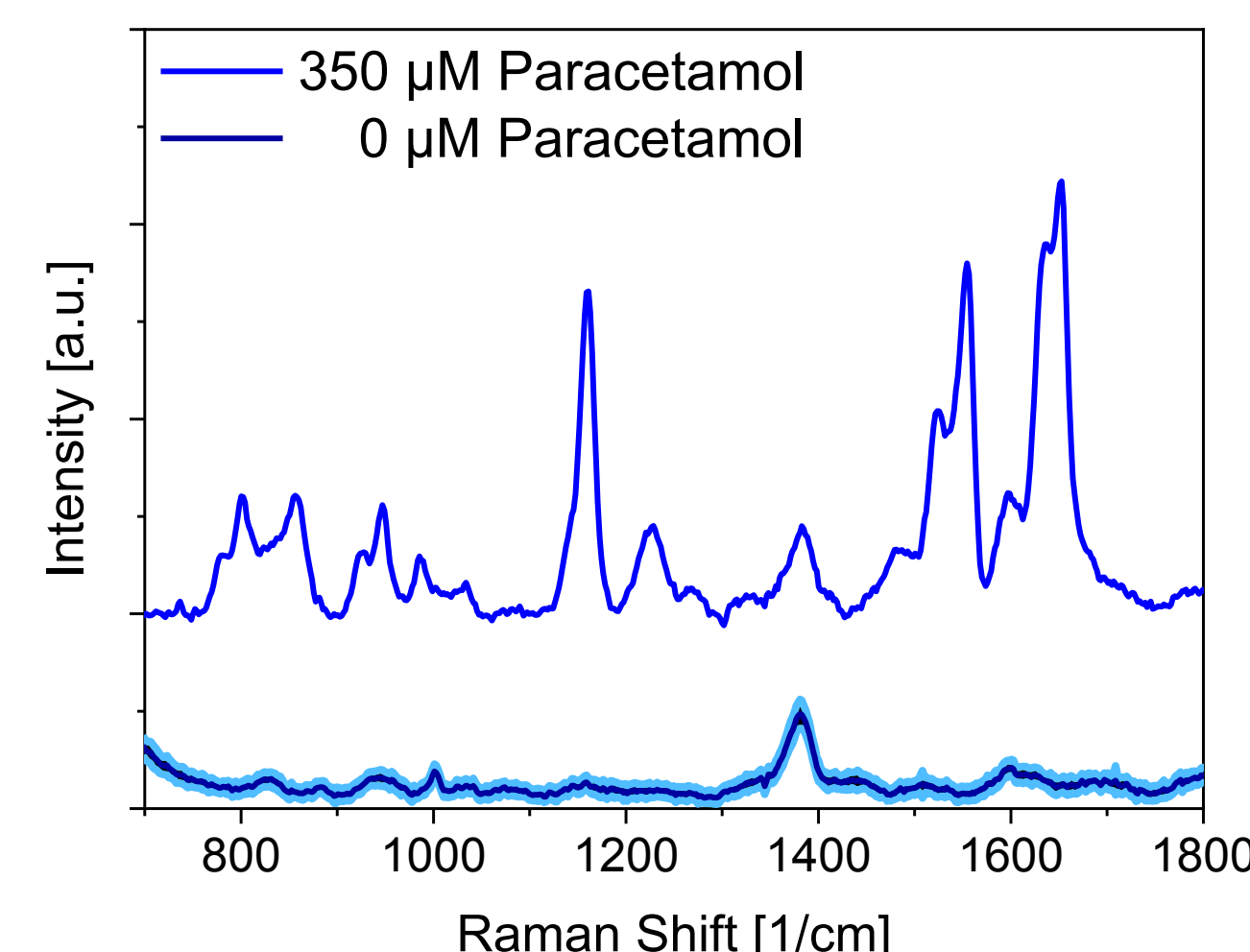


UV/ ozone surface treatment resulted in a lowered background signal, more defined peak shape and homogenous wettability in aqueous samples in comparison to untreated and pre-leaned samples. Optimal signals were obtained after **30 min** of treatment and samples were stable for **3 hrs** in an ambient environment.



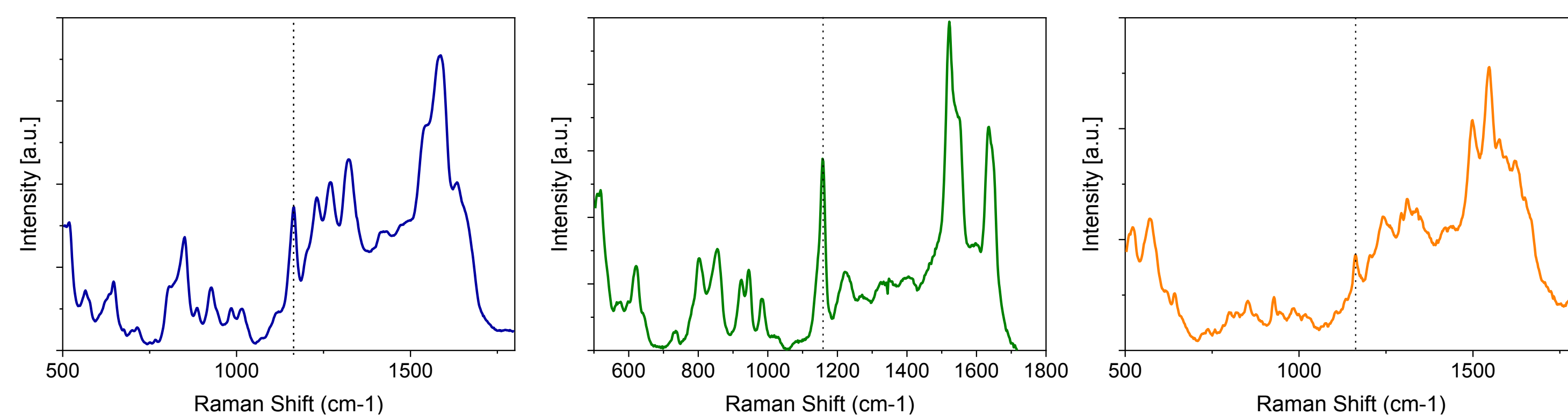
## Liquid Measurements

UV/ ozone treatment enabled the development of a novel liquid measurement technique for nanopillar SERS based sensing.



Direct Paracetamol detection in MQ was possible over a linear range of **5 – 100  $\mu\text{M}$** .

350  $\mu\text{M}$  Paracetamol spiked in **PBS**, **tap water** and unfiltered **river water** shows that UV/ Ozone pre-treatment allows detection in a realistic environment.



### Acknowledgement

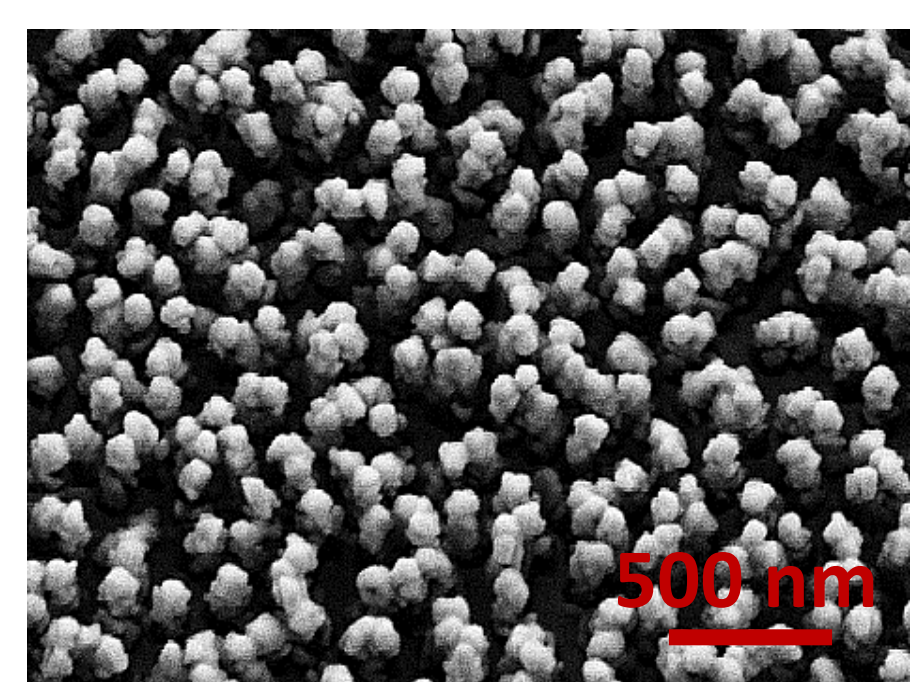
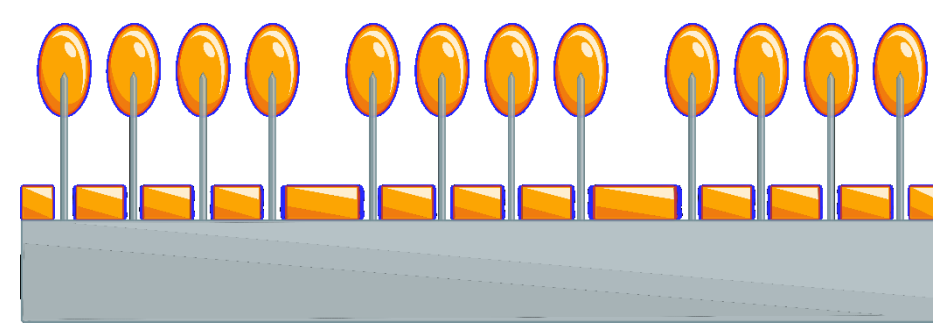
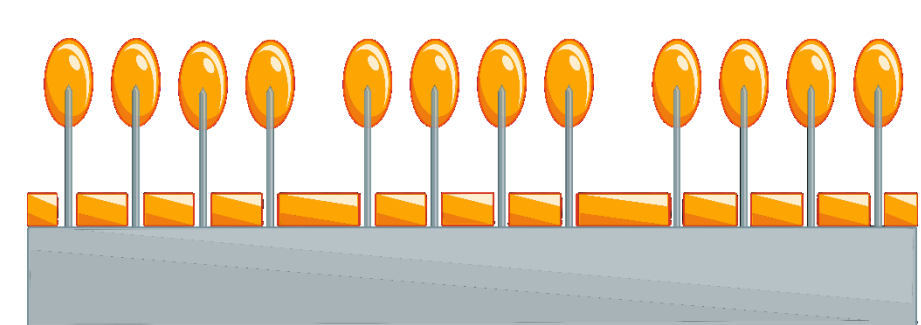
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### References

- [1] A. B. A. Boxall. "The environmental side effects of medication" in European Molecular Biology Organization, 2004, pp. 1110-1116
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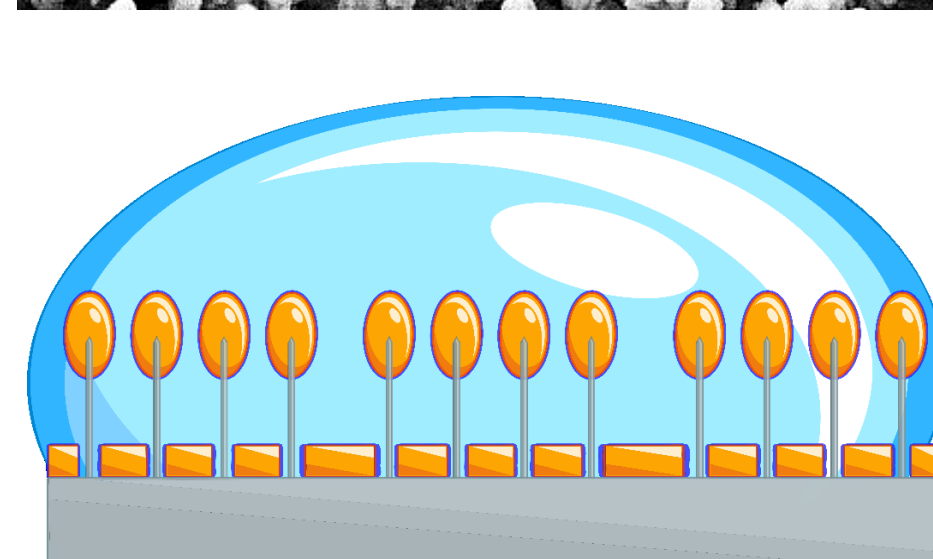
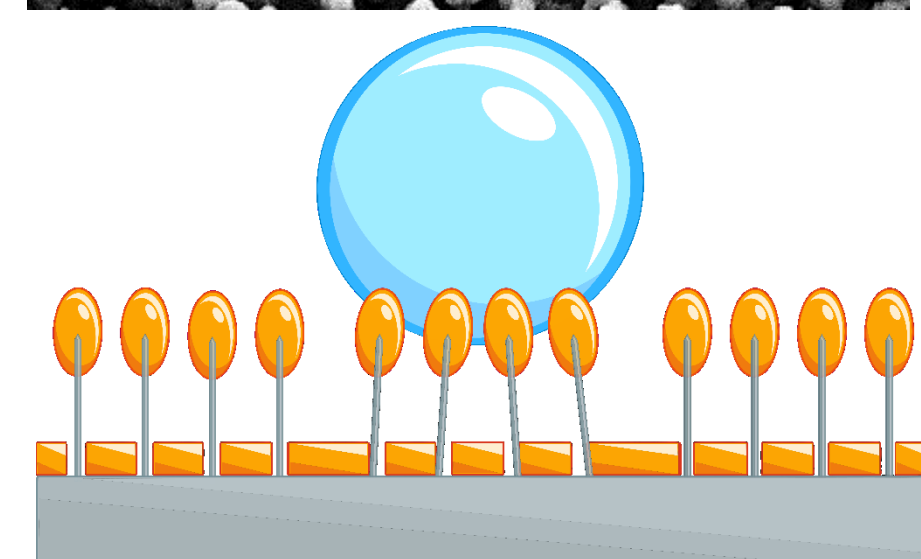
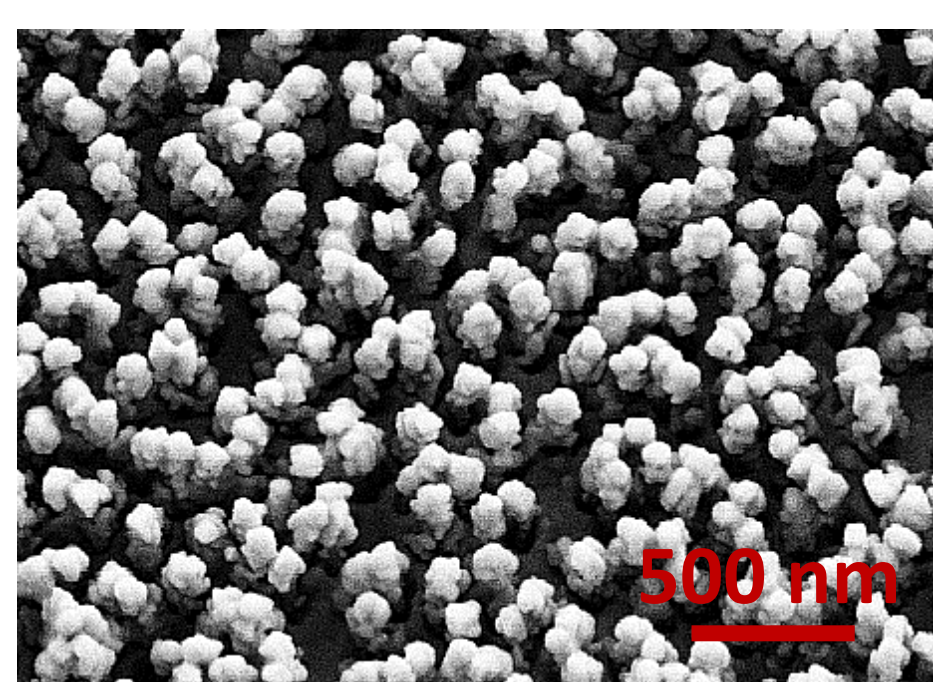
## Surface Treatment

UV/ ozone exposure is commonly utilized as surface treatment and cleaning procedure in a variety of microfabrication processes. It renders the surface of gold-capped nanopillars from hydrophobic to hydrophilic without any morphological alterations.



30 min

UV/ Ozone



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